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GLOSSARY OF SHIPS' HYDRODYNAMIC TERMS

PART II SHIP GEOMETRY

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PART II SHIP GEOMETRY

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GLOSSARY OF SHIPS' HYDRODYNAMIC TERMS

PART II SHIP GEOMETRY

0. FOREWORD

0.1 This Indian Standard (Part II) was adopted by the Indian Standards Institution on 27 October 1976, after the draft finalized by the Shipbuilding Sectional Committee had been approved by the Marine, Cargo Movement and Packaging Division Council.

0.2 The object of this standard is to specify the technical and scientific terms used in ship geometry, hydrostatic and hydrodynamic terms and to facilitate the exchange of information particularly at international level, and the ease of understanding as regards to documents relating to naval architecture.

0.3 The terms are represented by symbols which have been arranged in alphabetical order for ease of interpretation.

0.4 No rules are laid down as to whether subscripts are to be shown by capital or lower case letters, although the letters shown in this standard are in the preferred style.

0.5 When required, the suffixes M and S should be introduced to distinguish between quantities referring to model and ship respectively.

0.6 This standard is being issued in six parts. The other parts in the series are:

Part I Basic quantities
Part III Resistance and propulsion
Part IV Sea keeping
Part V Manoeuvrability
Part VI Strength and vibration

0.7 While preparing this standard, current work by ISO/TC 8 on 'Terminology of profiles and hydrodynamic terms' and International Towing Tank Conference (ITTC) has also been considered.

1. SCOPE

1.1 This standard (Part II) deals with terms related to geometry of ship.

2. TERMINOLOGY

Sl No.	Symbol	Term	Definition	Symbol of SI Unit
2.1	A_A	After perpendicular area section	Ship transverse cross-sectional area at the aft perpendicular	m^2
2.2	A_{BL}	Area of ram bow in longitudinal plane	The area of the ram projected on the middle line plane forward of the fore perpendicular*	m^2
2.3	A_{BT}	Area of transverse cross-section of a bulbous bow (full area port and starboard)	The cross-sectional area at the fore perpendicular. Where the water lines are rounded so as to terminate on the forward perpendicular, A_{BT} is measured by continuing the area curve forward to the perpendicular, ignoring the final rounding*	m^2
2.4	A_F	Forward perpendicular area section	Ship transverse cross-sectional area at the fore perpendicular	m^2
2.5	A_M	Area, midship section	Area of the immersed midship section, midway between fore and aft perpendiculars	m^2
2.6	A_T	Area of transom (full area port and starboard)	Cross-sectional area of transom stern below the load waterline	m^2
2.7	A_V	Area exposed to wind	Area of portion of ship above waterline projected normally to the direction of relative wind	m^2
2.8	A_W	Area, waterplane	Horizontal plane area enclosed between the intersection line of free water surface with the ship hull	m^2
2.9	A_X	Area, maximum transverse section	Ship transverse cross-section having the maximum immersed area	m^2
2.10	$\overline{AB}$†	Centre of buoyancy from aft perpendicular	Distance of centre of buoyancy from aft perpendicular	m
2.11	$\overline{AF}$†	Centre of waterplane from aft perpendicular	Distance of centre of waterplane from aft perpendicular	m

*Below the load waterline the stem contour sometimes recedes aft of the fore perpendicular before projecting forward to define the outline of the ram or fore end of the bulb. In such instances, this area should be calculated using as datum the aftermost vertical tangent to the contour instead of the fore perpendicular.

†Alternatively, the position of the centre of buoyancy B may be expressed in terms of the co-ordinate axes with an appropriate suffix, for example, X_B, Y_B and Z_B. The position of other items, such as the centre of gravity G, metacentre M and centre of flotation F could also be treated in the same way.

Sl No.	Symbol	Term	Definition	Symbol of SI Unit
2.12	$\overline{AG}$*	Centre of gravity from aft perpendicular	Distance of centre of gravity from aft perpendicular	m
2.13	B	Beam (or breadth) moulded of ship	Maximum moulded breadth at maximum transverse section measured at right angle with the plane of symmetry	m
2.14	B	Centre of buoyancy	Centre of gravity of water displaced	—
2.15	B_M	Breadth of midship section	Breadth measured on the designed waterline at the section, midway between fore and aft perpendiculars	—
2.16	B_x	Breadth of maximum transverse section	Breadth measured on the designed waterline at the maximum transverse section	—
2.17	(B)	R. E. Froude's breadth coefficient	$\frac{B}{\nabla^{\frac{1}{3}}}$	—
2.18	$\overline{BM}$*	Metacentre above centre of buoyancy	Distance from the centre of buoyancy B to the transverse metacentre M	m
2.19	$\overline{BM}_L$*	Longitudinal metacentre above centre of buoyancy	—	m
2.20	C_B, δ	Block coefficient	$\frac{\nabla}{LBT}$	—
2.21	C_{IL}	Coefficient of inertia of waterplane, longitudinal	$\frac{12\ I_L}{BL^3}$	—
2.22	C_{IT}	Coefficient of inertia of waterplane, transverse	$\frac{12\ I_T}{B^3L}$	—
2.23	C_M, β	Midship section coefficient (midway between forward and after perpendiculars)	$\frac{A_M}{B_M\ T_M}$	—
2.24	C_p, ϕ	Longitudinal prismatic† coefficient	$\nabla/A_x\ L$ (or $\nabla/A_M\ L$)	—
2.25	C_{PA}, ϕ_A	Prismatic coefficient† afterbody	∇ (afterbody)/$\frac{1}{2}\ A_x\ L$ [or ∇ (afterbody)/$\frac{1}{2}\ A_M\ L$]	—
2.26	C_{PE}, ϕ_E	Prismatic coefficient† entrance	∇ (entrance)/$A_x\ L_E$ [or ∇ (entrance)/$A_M\ L_E$]	—
2.27	C_{PF}, ϕ_F	Prismatic coefficient† forebody	∇ (forebody)/$\frac{1}{2}\ A_x\ L$ [or ∇ (forebody)/$\frac{1}{2}\ A_M\ L$]	—

*Alternatively, the position of the centre of buoyancy B may be expressed in terms of the co-ordinate axes with an appropriate suffix, for example, X_B, Y_B and Z_B. The position of other items, such as the centre of gravity G, metacentre M and centre of flotation F could also be treated in the same way.

†The prismatic coefficient should generally be based upon maximum-section area rather than on midsection area, but it should be clearly stated which area has been used. Whatever ship length considered appropriate may be used for this and other coefficients, but this length should be clearly indicated and stated.

Sl No.	Symbol	Term	Definition	Symbol of SI Unit
2.28	C_{PR}, ϕ_R	Prismatic coefficient* run	∇ (run)/$A_X L_R$ [or ∇ (run)/$A_M L_R$]	—
2.29	C_{VP}, ϕ_V	Prismatic coefficient* vertical	$\frac{\nabla}{A_W T}$	—
2.30	C_{WP}, α	Designed load waterline coefficient	$\frac{A_W}{LB}$	—
2.31	C_S	Non dimensional wetted surface coefficient	$C_S = \frac{S}{\sqrt{\nabla L}}$	—
2.32	C_X	Maximum transverse section coefficient	$C_X = \frac{A_X}{B_X T_X}$	—
2.33	C_{WS}	Wetted surface coefficient of Taylor	$C_{WS} = \frac{S}{\sqrt{\nabla L}}$	—
2.34	C_∇	Volumetric coefficient	$\frac{\nabla}{L^3}$	—
2.35	D	Depth, moulded, of a ship hull	Vertical height at midship from base line to the upper deck beam line	m
2.36	F	Freeboard	From the freeboard markings to the freeboard deck, according to official rules	m
2.37	F	Position of centre of flotation	Centroid of waterplane at which the vessel floats	—
2.38	$\overline{FF}$	Centroid of waterplane from forward perpendicular	Distance of centroid of water plane from forward perpendicular	m
2.39	$\overline{FB}$†	Centre of buoyancy from forward perpendicular	Distance of centre of buoyancy from forward perpendicular	m
2.40	$\overline{FG}$†	Centre of gravity from forward perpendicular	Distance of centre of gravity from forward perpendicular	m
2.41	f_{BL}	Area coefficient for ram bow	$f_{BL} = \frac{A_{BL}}{LT}$	m
2.42	f_{BT}	Taylor sectional area coefficient for bulbous bow	$f_{BT} = \frac{A_{BT}}{A_X}$	—
2.43	G	Centre of gravity	Point at which the weight of the ship is supposed to act	—

*The prismatic coefficient should generally be based upon maximum-section area rather than on midsection area, but it should be clearly stated which area has been used. Whatever ship length considered appropriate may be used for this and other coefficients, but this length should be clearly indicated and stated.

†Alternatively, the position of the centre of buoyancy B may be expressed in terms of the co-ordinate axes with an appropriate suffix, for example, X_B, Y_B and Z_B. The position of other items, such as the centre of gravity G, metacentre M and centre of flotation F could also be treated in the same way.

Sl No.	Symbol	Term	Definition	Symbol of SI Unit
2.44	$\overline{GM}$*	Metacentric height	Distance from the centre of gravity G to the transverse metacentre M	m
2.45	$\overline{GM_L}$*	Longitudinal metacentric height	Distance from the centre of gravity G to the longitudinal metacentre M_L	m
2.46	$\overline{GZ}$	Righting arm or lever	—	m
2.47	$\bar{i}_E$	Angle of entrance, half	Angle of waterline at the bow with reference to centre-plane, neglecting local shape at stem	—
2.48	$\bar{i}_R$	Angle of run, half	Angle of waterline at stern with reference to centre-plane, neglecting local shape at stern frame	m^4
2.49	I_L	Longitudinal moment of inertia of water plane	About transverse axis through centre of flotation	m^4
2.50	I_P	Polar moment of inertia	Second polar moment of area of a plane-surface related to a point in the plane	m^4
2.51	I_T	Transverse moment of inertia of water plane	About longitudinal axis through centre of flotation	m^4
2.52	$\overline{KB}$*	Centre of buoyancy above moulded base or keel	Distance from the centre of buoyancy B to the moulded base or keel K	m
2.53	$\overline{KG}$*	Centre of gravity above moulded base or keel	Distance from the centre of gravity G to the moulded base or keel K	m
2.54	$\overline{KM}$*	Metacentre above moulded base or keel	Distance from the transverse metacentre M to the moulded base or keel K	m
2.55	$\overline{KM_L}$*	Longitudinal metacentre above moulded base or keel	—	m
2.56	L	Length of a ship	Reference length of a ship (generally between the perpendiculars)	m
2.57	L_A	Length of afterbody	Length of the shipbody from midship section to after end	m
2.58	L_E	Length of entrance	From the forward perpendicular to the forward end of parallel middle body, or maximum section	m
2.59	L_F	Length of forebody	Length of the shipbody from midship section to forward end	m
2.60	L_{OA}	Length, overall	—	m

*Alternatively, the position of the centre of buoyancy B may be expressed in terms of the co-ordinate axes with an appropriate suffix, for example, X_B, Y_B and Z_B. The position of other items such as the centre of gravity G, metacentre M and centre of flotation F could also be treated in the same way.

Sl No.	Symbol	Term	Definition	Symbol of SI Unit
2.61	L_{os}	Overall submerged length	—	m
2.62	L_p	Length of parallel middle body	Length of constant transverse section	m
2.63	L_{pp}	Length between perpendiculars	—	m
2.64	L_R	Length of run	From section of maximum area or after end of parallel middle body to WL termination or other designated point	m
2.65	L_{WL}	Length of waterline in general	Longitudinal distance between extreme points of a waterline for a particular draught and trim	m
2.66	L_{DWL}	Length on designed waterline	Length at the waterline corresponding to the maximum load condition in calm water	m
2.67	(M)	R. E. Froude's length coefficient or length displacement ratio	$\frac{L}{\nabla^{\frac{1}{3}}}$	—
2.68	M	Transverse metacentre	Point where a vertical line, drawn through the centre of buoyancy when a ship is heeled, intersects the vertical line through the centre of gravity when it is floating in equilibrium. Transverse metacentre is approximately constant for angles of heel up to 10° and is generally known as 'initial metacentre'	—
2.69	M_L	Longitudinal metacentre	A metacentre which exists for longitudinal inclination and is analogous to transverse metacentre	—
2.70	S	Wetted surface	—	m^2
2.71	(S)	R. E. Froude's wetted surface coefficient	$\frac{S}{\nabla^{\frac{2}{3}}}$	—
2.72	t	Taylor tangent to the area curve	The intercept of the tangent to the sectional area curve at the bow on the midship ordinate expressed as a ratio of the midship ordinate*	—
2.73	T	Draught, moulded, of ship	—	m

*If the sectional area at the end ordinate is not zero (for example, when there is a bulbous bow) both intercepts should be diminished by that area in evaluating t.

Sl No.	Symbol	Term	Definition	Symbol of SI Unit
2.74	T_A	Draught, aft	Draught measured at the intersection of the after perpendicular with the baseline (if the ship has a sloped or raked keel, it is measured at the intersection with the keel line)	m
2.75	T_E	Draught extreme	Draught measured at the lowest part of the ship or its appendages	m
2.76	T_F	Draught, forward	Draught measured at the intersection of the forward perpendicular with the baseline (or the keel line if the ship has a sloped or raked keel)	m
2.77	T_M	Draught, mean or mid-length	Draught measured at the mid-section. For a ship with straight keel $T_M = \frac{T_F + T_A}{2}$	m
2.78	Ⓣ	R. E. Froude's draught coefficient	$\frac{T}{\nabla^{\frac{1}{3}}}$	—
2.79	Δ	Displacement weight	$\nabla \cdot W$	N
2.80	λ	Scale ratio	Ship dimension/model dimension	—
2.81	∇	Displacement volume	—	m^3
2.82	μ	Permeability volume	The ratio of the volume of water entering a compartment to the volume of the compartment	—

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